Pier No. 13

Tested September 21st, 1918. Age, 94 days.
Height, 4 ft. ⅞ ins. = 16 courses. Lime mortar.
E = 142,000 lbs. per sq. in.
Strength = 300 lbs. per sq. in. l/d = 5.6.

Load	Deformation	Load	Deformation
000 lbs.	.000 ins.	18,300 lbs.	.089 ins.
2,000 "	.010 "	21,000 "	*.119 "
9,400 "	.042 "	22,000 "	failed
14,400 "	.063 "		

*First cracks, seventh and eighth from bottom.

Pier No. 14

Tested September 21st, 1918. Age, 95 days.
Height, 12⅛ ins. = 4 courses. Lime mortar.
E was not determined.
Strength = 550 lbs. per sq. in. l/d = 1.4.

Summary

1.—The strength of the strongest pier laid in cement mortar was 78% of the strength of the individual brick.

2.—The strength of the strongest pier laid in lime mortar was 55% of the strength of the individual brick.

3.—Brick masonry laid in cement mortar is about 50% more rigid and 60% stronger than that laid in lime mortar, and the resistance to shock is 60% greater in the former than the latter.

4.—Longitudinal or vertical rupture through bonding courses occurred very frequently.

5.—No appreciable shrinkage in height could be observed during the first month after construction. After this period, measurements were discontinued.

6.—Lateral deflections under load were in most cases so small as to be almost incapable of measurement with a scale divided into 100th of an inch.

7.—As a result of the tests, the following formulae for the strength of brick piers in lbs. per sq. inch are suggested (the first being for cement and the second for lime masonry):—

P = 828—34 l/d.
P = 620—50 l/d.

Prof. Gillespie proposes the following formulæ for the strength of brick piers in lbs. per sq. ft.:—

P = 110,000—3,000 l/d (cement mortar).
P = 80,000—3,000 l/d (lime mortar).

Some very valuable tests have been made by the U. S. Department of Commerce (see technologic paper No. 111 of the Bureau of Standards, Washington, D.C.). Tests made on large brick piers were reported and a general survey made of all previous tests conducted on the subject.

In having the tests made at Toronto University, the writer had in view an attempt to get up a curve or straight line that would be reasonably safe to be used for different ratios of l/d, but the few tests made would not warrant anything definite. It is hoped to have a great number of brick piers tested this year so that a reasonable formula for brickwork may be secured.

It is also the intention to test tile piers of the same lengths as the brick piers, so as to determine their comparative or relative strengths. Other building materials will also be tested in similar manner, so that the Department may take brick as the standard, or unit, and rate the other materials higher or lower, expressing their value in terms of brick as the unit.

ONTARIO BUILDERS ELECT OFFICERS

At the annual convention of the Provincial Builders' and Supply Dealers' Association of Ontario, held last week at Chatham, Ont., the following officers were elected for the ensuing year: President, H. Elgie, Toronto; first vice-president, Col. J. L. Young, V.C., Stratford; second vice-president, John Hildreth, Chatham; secretary-treasurer, T. R. Wright, London. Board of Directors: W. H. Palmer, Chatham; L. A. Boss, London; R. M. Norton, Sarnia; G. Thomas, Galt; W. Murray, Hamilton; R. H. Nicholson, St. Catharines; and C. A. Crow, Ottawa.

THE STRENGTH OF LARGE BRICK PIERS

A FINAL report on an investigation of the strength of large brick piers has been issued as Technologic Paper No. 111 by the U.S. Bureau of Standards, says "Engineering & Contracting." The investigation was conducted in the Pittsburgh Laboratory of the Bureau in co-operation with the National Brick Manufacturers' Association. Tests were made on 40 piers 30 in. x 30 in. x 10 ft. high, and four supplementary piers of the same cross sectional dimensions by 5 ft. high. The bricks used were representative of four districts east of the Mississippi River. The conclusions based on the results of the investigations and study of previous tests were as follows:

The primary failure of brick piers is caused by a transverse failure of the individual bricks.

The ultimate strength of the pier may be increased by any method of construction which will increase the depth of the component parts of the pier. This may be done by (1) laying the bricks on edge instead of flat, (2) breaking joints every few courses instead of every course, or (3) using bricks of more than ordinary thickness.

The strength of the pier may be increased by the introduction of wire mesh in all horizontal joints. The increase is slight, however, unless the mesh is used in every joint.

Varying the number of header courses used does not appreciably affect the ultimate strength of the pier.

The mortar joints should be made as thin as possible. They should be of uniform thickness. For this reason regularity in shape of the bricks is essential.

The ultimate strength of brick piers is proportional to the compressive and transverse strength of the bricks used in their construction.

The kind of mortar used is important in its effect on the strength of brick masonry. A pure lime mortar is inefficient when a high compressive strength is desired. In a mortar of 1 part Portland cement to 3 parts sand, 25 per cent. by volume of the cement may be replaced by hydrated lime without appreciably affecting the strength of brick piers. Higher percentages of lime up to 50 per cent. by volume may be used on piers of small cross sectional dimensions.

The following empirical formulas for use in computing the strength of brick piers are derived from the tests of the investigation:

(1) P = K p
(2) P = K R, where

P = the ultimate unit compressive strength of the pier,
p = the unit compressive strength of the single bricks.
R = the unit transverse strength or modulus of rupture of the single bricks,
K is a constant depending upon the grade of mortar used, and for which the following values are given:

Mortar.	Values to be determined by tests of individual bricks.	Value of K
15 per cent. lime; 85 per cent. cement, to 3 parts sand, by weight	Unit compressive strength flat = p	0.26
	Unit compressive strength on edge = p	.30
	Modulus of rupture from transverse test = R	1.25
1 part lime to 6 parts sand	Unit compressive strength flat = p	.11
	Unit compressive strength on edge = p	.14
	Modulus of rupture from transverse test = R	.65
1 part cement to 3 parts sand	Unit compressive strength flat = p	.27
	Unit compressive strength on edge = p	.32
	Modulus of rupture from transverse test = R	1.45